Pennsylvania High Speed Intercity Rail Passenger Commission Final Report

Executive Summary

Pennsylvania High Speed Intercity Rail Passenger Commission

(Established 1983, Expired Dec. 31, 1987)

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This report was prepared by the High Speed Rail Foundation to summarize and update the Final Report of the Pennsylvania High Speed Intercity Rail Passenger Commission. It was edited by Robert J. Casey and reviewed by the following persons: Dan Cupper, who was executive editor of the commission, William Dickhart, consultant to Transrapid International, Hon. Rick Geist, who was chairman, Dottie Ketner, former executive secretary of the Commission, Paul H. Reistrup, who was a member of the Oversight Consultant team, Richard C. Sullivan, who was a member of the Commission, and Joseph Vranich, a consultant who was not part of the Commission or study.

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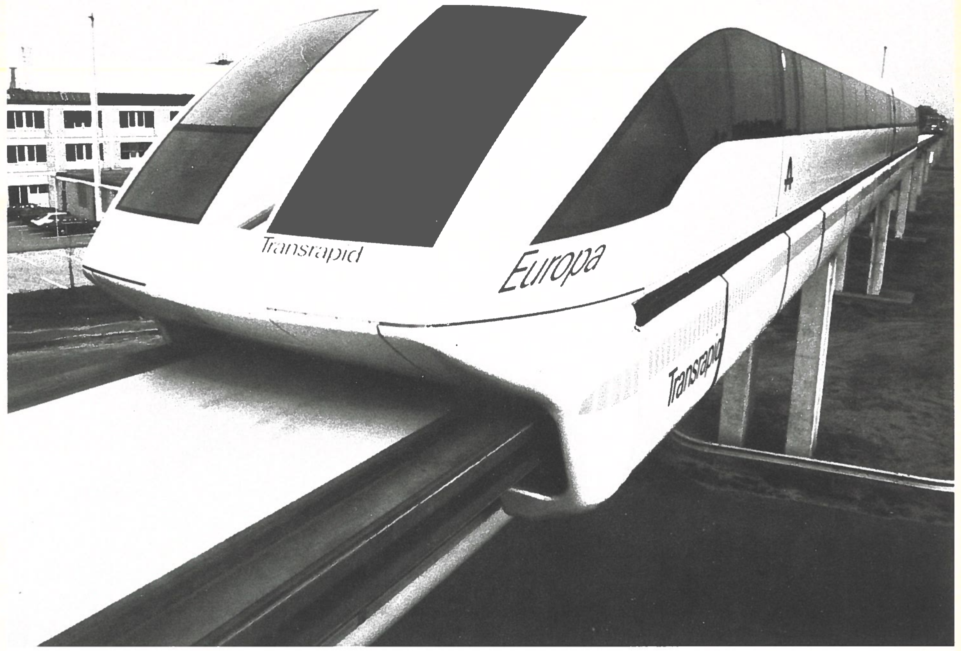


EUROPA, the latest version of the Transrapid International maglev, was introduced in 1989.

RECOMMENDATIONS

1. Magnetic levitation should be the technology of choice for a cross-Pennsylvania high-speed rail system. Advanced steel-wheel technology should be considered an alternative strategy.

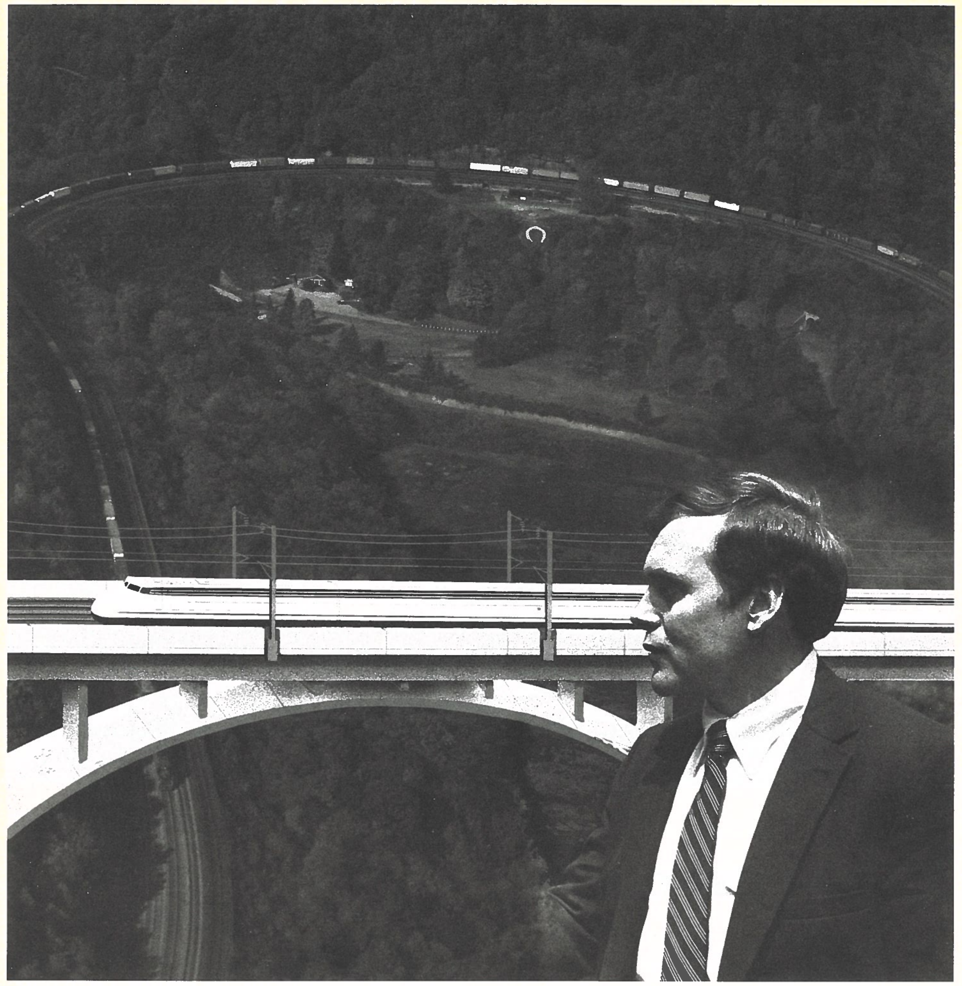
2. The General Assembly should authorize the first steps toward implementation of high-speed rail. (A sample of the consultants' suggested legislative language is included in the final report, but not in this summary.)

3. The Commonwealth should authorize negotiations with the West German consortium, Transrapid International, concerning financial assistance, to determine the nature and extent of that financing and under what conditions it may be extended. This investigation should determine what the actual cost of the construction likely will be; what proportion of that cost likely will be covered, or whether all of it will be covered, by the proposed offshore financial assistance; and what sources are available to make up the difference, if any.

4. At the same time, issues that could not be covered in this commission's final phase of feasibility work should be addressed. Specifically, these include a more cost-effective alignment; a financing plan, including determination of details of the Transrapid proposal; an engineering analysis of the Transrapid proposal; and a final economic impact assessment.

5. If financial assistance fails to materialize to permit implementation of state-of-the-art technology, the Commonwealth should consider alternative strategies, such as building the system in stages or accepting a lower-cost (with correspondingly lower performance and less dramatic economic benefit) technology.*

** While not a formal recommendation of the full commission, this opinion is held by a substantial minority of its members, and it reflects one implementation strategy proposed by the general engineering consultant. Although the commission consistently has favored higher technologies, it has never ruled out pursuit of cost-effective alternatives.*



Rep. Geist at Pennsylvania's famous Horseshoe Curve, with an artist's rendition of a high speed train.

CHAIRMAN'S REPORT

By Representative Rick Geist

Magnetic levitation, the first choice of the Pennsylvania High Speed Intercity Rail Passenger Commission, is "flying without wings."

In the 1950s, the Interstate Highway System was in the center of all transportation planning. The following decade brought the building of airports to a fine art. During the 1970s, subways and local transportation systems began to get the spotlight of public attention.

Now, with the population in urban corridors booming, with increasing air and highway gridlock and environmental problems, and with safety problems in both modes, many states are considering creation of high speed rail systems. These range from upgraded Amtrak service, tilting trains and ones similiar to the Japanese Bullet train and the French TGV all the way to 300 mph magnetic levitation systems.

The Pennsylvania High Speed Intercity Rail Passenger Commission in one of its last official acts voted for magnetic levitation (maglev) as its first choice.

Magnetic levitation vehicles are lifted and propelled along and above a guideway by a wave of magnetic energy. They actually are flying, but because they surround the guideway, they cannot "derail." On December 21, 1979, an unmanned Japanese maglev vehicle reached 321 mph, and on January 22, 1988, a German maglev with passengers on board reached 258 mph. This was the same vehicle that members of the Pennsylvania commission rode two years earlier. High speed rail systems, including maglev, are the safest form of transportation in the world; they are smooth, comfortable, reliable and fast. And speed sells.

The Japanese were the first to prove this. When they built the Shinkansen (New Trunk Line) in 1964, it was the equivalent of the Pennsylvania Turnpike's pioneering highway in its time. With trains traveling at 130 mph, the Japanese "Bullet" proved to be popular and profitable.

Other countries entered the high speed rail field and by 1984, the French TGV (Very High Speed) train was traveling between Paris and Lyons at 170 mph.

Today, new speed records are being established almost every month. But there is another "race." It is a competition among a dozen American states to determine which will be first to have a high speed rail system. The winner undoubtedly will reap many economic benefits, but the others will also gain great economic rewards.

This Executive Summary and the full Final Report of the Commission show without a doubt that a high speed rail system would provide vast economic benefits to our state, as well as a fantastic new transportation system to bring together our two largest cities, the state capitol and a number of other cities.

This report is based on a $4 million four-year effort by the Commission and its study team. It is probably the finest and most accurate such study ever accomplished in the United States.

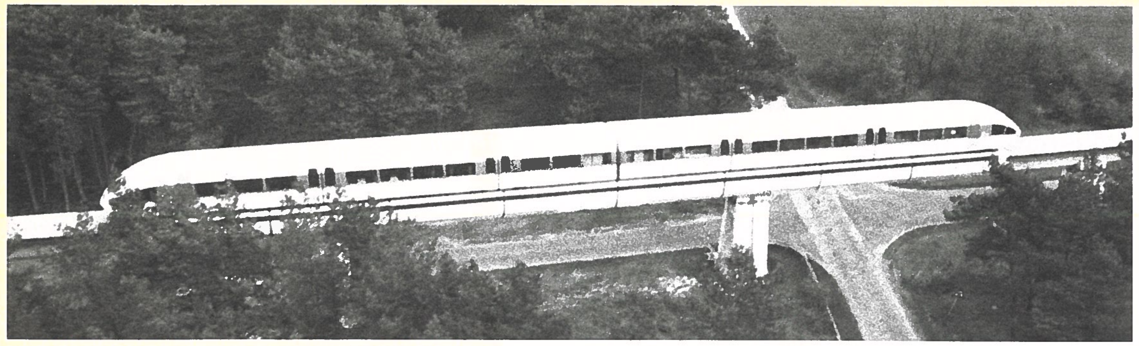
The Pennsylvania ridership study, a major and central part of the project, has been called "the most rigorous and accurate ridership projection so far" by Planning Magazine.

The ridership study was performed by the general contractor, Parsons Brinckerhoff Gannett Fleming. It is interesting to note that the Parsons firm also made the study for the Pennsylvania Turnpike that predicted 1.3 million vehicles the first year. The actual count for that first year was 2.4 million vehicles. We believe the firm was just as conservative in their projection for Pennsylvania High Speed Rail.

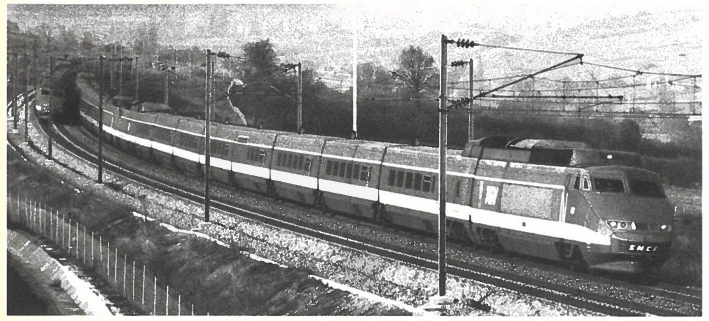
The most pressing need at this time is for a state-authorized ridership study which will update and relate the Commission's 1986 Ridership Survey to the magnetic levitation proposal of Transrapid International.

The Commonwealth should act now to form a public-private partnership authorized to work with Transrapid International (or other consortium) in order to assure a 21st Century cross-state transportation system. It will benefit the environment, the economy, travel safety, tourism and it will combat gridlock.

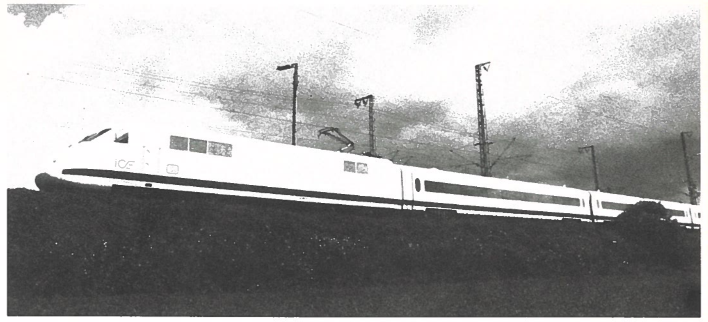
Richard A Geist



The Transrapid maglev crosses a highway intersection.



Two French TGV trains pass on the Paris-Lyons route. Newer versions of the TGV travel at 186 mph.



The German ICE train, a product of the German National Railway, operates between Hannover and Wurzburg. It has reached 252 mph in trial runs.

EXECUTIVE SUMMARY

The Pennsylvania High Speed Intercity Rail Passenger Commission was created by Act 144 of 1981 to study the prospects for bringing high-speed rail service to the Philadelphia-Harrisburg-Pittsburgh corridor, and intermediate stations. The commission was given responsibility to assess the need and demand for high-speed rail passenger service; construction costs and available technologies; possible location and extent of specific routes to be served; economic impacts of construction and operation; financing options; and local issues.

Parsons Brinckerhoff Quade & Douglas of Philadelphia and New York City and Gannett Fleming Transportation Engineers of Camp Hill, Pa., formed a joint venture (Parsons Brinckerhoff/ Gannett Fleming, or PBGF) to conduct the feasibility study. STV Engineers of Pottstown, Pa., and New York City served as oversight consultant to cross-check PBGF's assumptions and analyses. Nearly $4.2 million in state, federal and West German grant funding was spent on the study. This report summarizes the work of PBGF and STV as well as the contributions of French and West German engineers and suppliers.

DEFINITION OF HIGH-SPEED RAIL

High speed rail passenger service as discussed in the study means:

- Passenger trains operating at between 125 mph and 250 mph or more.
- Right-of-way dedicated exclusively to high-speed passenger service.
- The right-of-way would be free of highway grade crossings.
- Frequent departures — approximately hourly throughout the day.
- Business-class on-board services and amenities.
- Clean, appealing, centrally located stations with adequate parking.
- A commitment to reliability and performance.

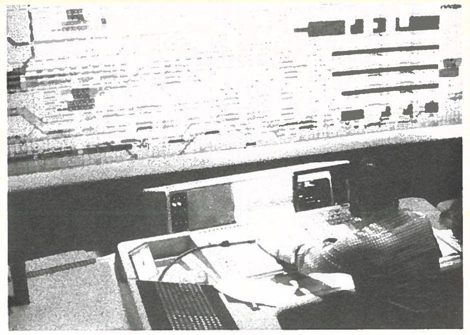
For travelers, high-speed rail offers safety, speed, convenience, frequent departures, reliability and all-weather service. For the state's economy, high speed rail offers construction employment, expansion of the tax base, real-estate development near stations, creation of a new industry and support for the state's mature railroad-supply industry. In addition, high speed rail brings broader benefits, such as environmental protection, sound land-use policies, improved mobility, and a measurable boost in the state's image as a place in which to live and do business. Some of the benefits high speed rail can bring to Pennsylvania are:

- Cross-state travel time of two to three hours.
- As many as 25,000 jobs during construction, and half that many in the long run.
- Revitalization of downtown areas. Creation of a state-of-the-art, environmentally sound mode of transportation.

HIGH-SPEED RAIL FOR PENNSYLVANIA

Pennsylvania is a candidate for high-speed rail because it has two large cities about 300 miles apart, the larger of which is anchored into the heavily traveled Northeast Corridor. In between are a capital city and several significant smaller cities. The corridor length is ideal for high-speed rail. High-speed rail can successfully compete on a cost and time basis. The commission's ridership demand studies show that a passenger market exists to support high-speed rail. Several proposed routes were examined; all would service the following intermediate stations: Great Valley/Paoli, Lancaster, Harrisburg, State College and/or Lewistown, Altoona, Johnstown and Greensburg. The eastern terminus would be at Amtrak's 30th Street Station in Philadelphia, which offers connections to Amtrak's Northeast Corridor and new Atlantic City service, and local suburban service, including trains to Philadelphia International Airport. The western terminus would be a new station at Pittsburgh's Station Square, connecting with local transit systems.

High-speed rail can overcome the weather-related difficulties of traveling over the Allegheny Mountains in winter. Further, it offers a way for travel to expand, which is not possible at traffic-clogged airports in Pittsburgh and Philadelphia. Federal studies show that demand for transportation is increasing, while the



SAFETY: High speed rail, in more than 25 years of operation, is the only transportation mode with a clean safety record, i.e., no passengers injured, no passengers killed. At the heart of the safety system is the computer automatic train control.

The German ICE passing an older electrified train. It is scheduled to go into full operation in 1991.

options for meeting that demand are growing increasingly restricted. Automobile fuel is readily available at a moderate price, but disruptions in Mideast supplies could change overnight. High-speed rail would help preserve mobility.

FOREIGN INVESTMENT POTENTIAL

During the course of the feasibility study, high-speed technology suppliers, particularly the West German magnetic levitation consortium Transrapid International, became so sure of the market for passenger travel in Pennsylvania that they made overtures regarding foreign financing for a system here. Leadership and a political consensus are needed to pursue this and other possible avenues of funding. Such a consensus is succeeding in other states; California-Nevada, Florida, Ohio and Texas are moving ahead with plans for high-speed rail systems.

WHAT THIS REPORT DOES NOT COVER

The feasibility study was nearly completed when the staff was terminated by the governor's financial aide four months prior to the "sunset" date. This curtailed the work. Many of the findings are favorable to high-speed rail. However, particularly on the issues of financing and optimum alignment, the study was incomplete, and additional essential work was left undone. A fair reading of the proposal's ultimate feasibility cannot be gained until those issues are resolved.

Among the tasks remaining are a final assessment of economic impact; a detailed financing plan; an engineering plan and computer runs to verify projections for a modest-performance alternative (Option 3) suggested by a financial consultant; revisions to right-of-way alignment to reflect cost reductions and improvements; an independent engineering assessment of the proposed Transrapid International plan for building and helping to finance a magnetic levitation line between Harrisburg and Pittsburgh; and determination of the nature of Transrapid's offer to assist in procuring financing.

FINDINGS

The Commission finds that:

1. High speed rail technology is available today.

2. A sufficient market exists in east-west travel to warrant further pursuit of high speed rail for Pennsylvania.

3. High speed rail will introduce beneficial short- and long-term economic effects to the Commonwealth.

4. The greatest such effect would be on new and developmental business, the construction industry and rejuvenation of railroad-related industry.

5. The greatest benefits would come from the most innovative system, i.e., magnetic levitation, closely followed by a high-performance steel-wheel system such as the French TGV or West German ICE.

6. A modest upgrading of Amtrak service would offer significant travel-time improvements and may be least expensive, but it provides the least economic benefit among options studied.

7. Under the conditions existent in 1987, the project would require substantial initial investment, with the long-term benefits directly proportional to the size of the initial investment.

8. Both West German and French suppliers have offered to help secure offshore financial assistance — grants and/or loans — to construct their high speed rail systems in Pennsylvania.

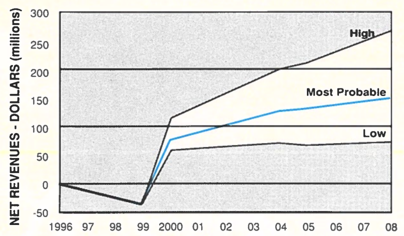
9. With such offshore help, the best-case scenarios (steel-wheel system at 180 mph or maglev at 250 mph) may be financially feasible now, based on the record of public and private financing of high-speed rail worldwide.

Editor's Note: The passage of federal legislation in late 1988 authorizes high speed rail tax-free bonding authority.

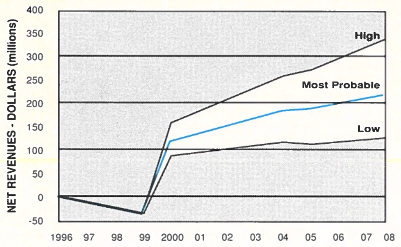
TECHNOLOGY AND OPERATIONS

This study considered high-speed trains that are operating in daily commercial service, as well as experimental test designs. The choice of technology will govern the quality of service, capital cost, the extent of the Commonwealth's financial support required and the relative risk and payback. It also will determine how much economic development occurs. The faster the trains, the greater the patronage, and the greater the impact on the state's economy.

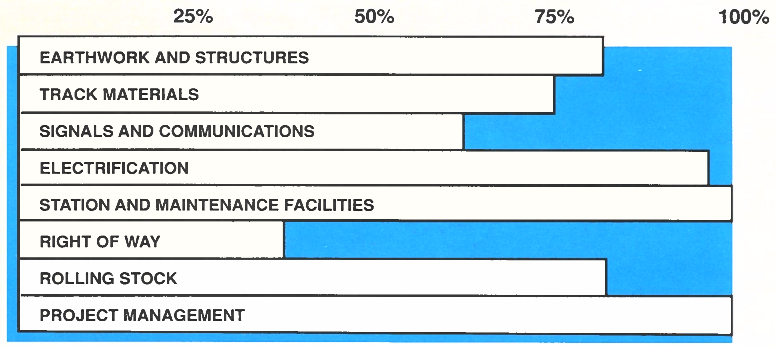
Advanced Steel Wheel System Net Revenues



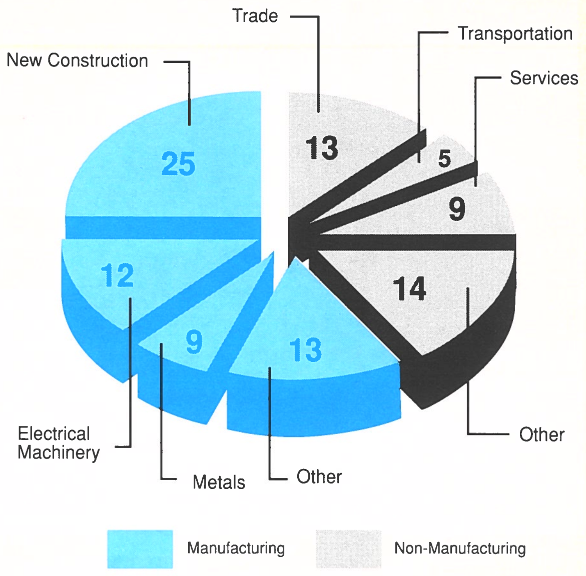
Maglev Net Revenues



Pennsylvania's Estimated Share of Construction Expenditures



Distribution of Construction Period Impacts by Industry Sector



The High-Speed Rail System Concept

The high-speed rail operating concept envisions a complete service to the traveler: Ample parking, access to public transportation, checked baggage, seat reservations, snack and beverage service, hourly departures. Depending on technology, the cross-state trip time could take from about two hours to 3 hours 43 minutes, with improved ride quality, compared with seven hours today. Passenger-train-only trackage enhances safety, speed and on-time reliability. As in France and Japan, this approach eliminates dangerous highway grade crossings, and eliminates dispatching interference with slow freight trains and start-and-stop commuter trains. This makes track maintenance easier and provides a safety margin by reducing the chance for collisions or derailments. It also allows steeper grades, reducing the need for costly tunnel excavation. Indeed, the Transrapid International proposal has no tunnels at all.

Steel-Wheel-on-Steel-Rail Technology

The French TGV (tres grande vitesse, or very great speed) fleet is the world leader in existing commercial technology. Since 1983, 87 electrified trains have operated between Paris and Lyons at 168 mph. The system yields a 17 percent return on equity after debt service. A fleet of second-generation TGV's will run at 186.4 mph on a new route from Paris to the west of France and north to Brussels and the English Channel Tunnel.

Under construction is a fleet of similar West German ICE (Inter-City Express) trains. A prototype has been tested at 252 mph and the German railroad has placed an order for production (41 trainsets of two locomotives and 11 cars) to service new high-speed routes at 155 mph.

The Japanese Shinkansen, or Bullet Train, is the world's first true high-speed rail system, having gone into operation on October 1, 1964, at a commercial speed of 130 mph; some routes now operate at 150 mph. The fleet has carried almost 3 billion passengers without a single fatality or injury.

Other high-speed electric train types planned for 140 mph operation or more are two Italian designs (ETR 450 and ETR 500) and the British "Electra". Trains operating or planned to operate at 125 mph include the British diesel Inter-City 125, the Spanish Talgo, a pendular "passive" tilting-coach system; Amtrak's AEM-7 locomotive-hauled Metroliner in the Northeast Corridor; and the Swedish X2, an "active" tilting-body train.

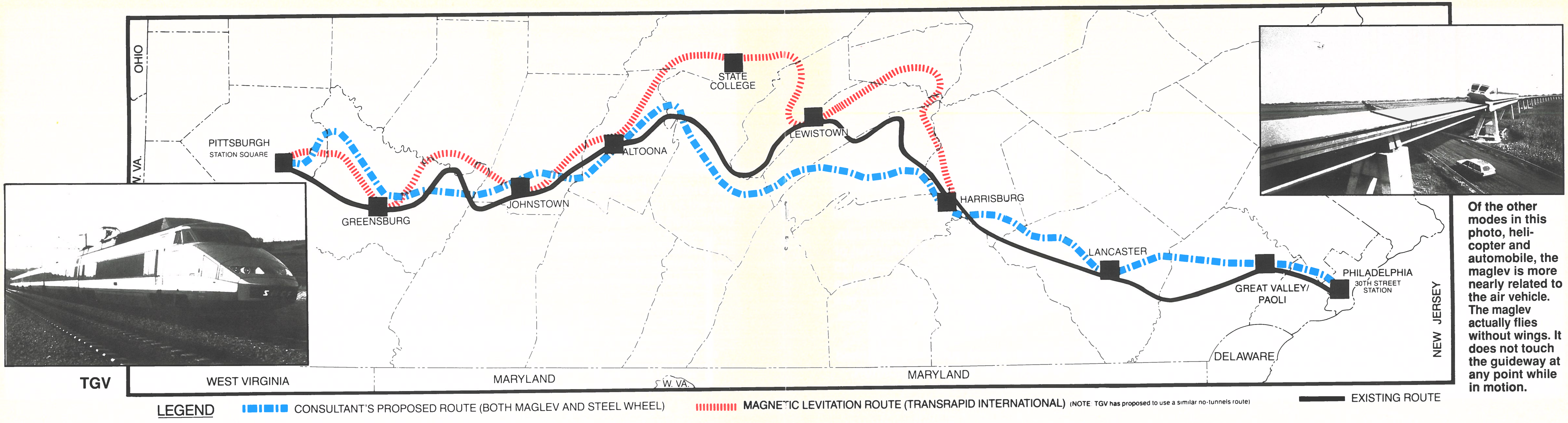
Banking Mechanisms

Several of these systems use tilting-body coaches, in which the cars are mechanically banked through curves, reducing the discomforting effect of centrifugal force on passengers. Thus, roughly one-third higher speeds can be maintained through curves without costly track realignment. Reliability has been erratic for "active" banking systems, in which motors tilt the car bodies. The Spanish Talgo system uses gravity to achieve a "passive" tilting effect, which has been in use in Spain and on international routes for nearly 20 years.

Magnetic Levitation Technology

This technology uses no wheels or rails, but a concrete or steel guideway, above which the vehicle is magnetically suspended and centered, and along which it is propelled by a wave of magnetic energy. With no wheel-to-rail contact, the "maglev" vehicle actually flies along the guideway, so there is potential for greater speeds — 250 to 300 mph. No maglevs are operating in revenue service, but tests in West Germany and Japan have yielded performances at more than 300 mph. And the implementation of a first maglev line in Germany has been recommended to the Government by the Parliament (alternatively Hamburg - Hanover or Essen - Bonn).

At the 20-mile Transrapid International test track at Emsland, West Germany, a two-car TR-06 vehicle has tested at 258 mph. This system uses a T-shaped guideway around which a part of the vehicle wraps,



TGV

Of the other modes in this photo, helicopter and automobile, the maglev is more nearly related to the air vehicle. The maglev actually flies without wings. It does not touch the guideway at any point while in motion.

eliminating the possibility of derailment. Electromagnets energized in the lower portion of the wraparound segment give the train its levitation by pulling up toward the longstator mounted on the underside of the guideway. Additional magnets provide lateral guidance, or centering. A longstator electric motor, with windings mounted on both sides of the guideway, reacts with electromagnets mounted beneath the main body of the vehicle. The rapid changing of polarities induces a pushing and pulling force, creating propulsion. Japanese Railways has tested the MLU-001 magnetic vehicle at 250 mph on a 4.2-mile track at Miyazaki, Japan. (An unmanned vehicle achieved 321 mph in 1979). This system uses a U-shaped guideway; the vehicle is lifted from the bottom of the guideway and repelled from its sides by the use of electromagnets. Forward motion is generated in the same manner as with the attractive system. Other vehicles, such as the Japan Air Lines HSST-03, have operated reliably in low-speed shuttle service, and have been tested at 191 mph.

Applicability to Pennsylvania

Most of the technologies listed are suitable for use in the Philadelphia-Harrisburg-Pittsburgh corridor. All maglev systems would require construction of a new guideway for the entire length of the route.

Benefits of Maglev

- Greater economic impact than steel-wheel system, more jobs during construction; heavier passenger usage upon completion.
- Establishment of state-of-the-art transportation in Pennsylvania and the United States, and establishment of an entirely new technology as a new industry in Pennsylvania.
- Would allow export of specialized maglev technology to other states, creating more jobs and economic growth.
- Higher train speeds (250-300 mph rather than 150-180 mph) which would induce additional ridership.
- Potentially lower operating and maintenance cost than steel-wheel-on-steel-rail designs.
- The alignment and the construction of the guideway can more exactly adopt to the terrain compared with steel wheel.
- Environmentally superior to highways as a means of handling transportation growth in Pennsylvania.
- The innovative concept could attract new-technology financing.
- The Transrapid International group has offered financing for this option.

Disadvantages of Maglev

- Operation under Pennsylvania weather conditions not yet tested.
- No revenue service system experience.
- Neighboring states and Northeast Corridor not considering maglev as an alternative; thus, through service is precluded on trips such as Pittsburgh-New York or Harrisburg-Atlantic City, NJ.
- Risks associated with new technology may pose financing problems in the traditional marketplace.

Benefits of Steel-Wheel

- Broad-based proven service experience of steel-wheel on steel-rail mode reduces implementation risk and financing risk.
- Would allow export of high-speed technology to other states, creating more jobs and heightening economic impact in Pennsylvania.
- Supports state's existing railroad manufacturing and supply industry.
- Compatible with existing Northeast rail system; allows through service to New York, Washington, Atlantic City; also compatible with high-speed rail plans of Ohio, New York, and other states.
- Makes maximum use of existing rail rights-of-way in Pennsylvania; service could begin as an upgrading of conventional service now offered between Philadelphia and Harrisburg.
- Environmentally superior to highways as a means of handling transportation growth in Pennsylvania.
- Potential to achieve full electrification, full separation of freight and passenger services, full elimination of grade crossings.

Disadvantages of Steel-Wheel

- Some of investment may be lost if system subsequently is upgraded to maglev.
- Overall economic impact likely not as great as with maglev.
- Unlikely to match maglev in speed.
- Prospects less certain for establishing state-of-the-art American high-speed rail industry in Pennsylvania.

OPTIONS FOR PENNSYLVANIA

From technical, financial and operating standpoints, three types of systems were studied as candidates for implementation in Pennsylvania. Based on the consultants' work in Phase 1 and Phase 2 of the feasibility study, the commission voted to pursue the most technologically advanced systems -- a 250 mph maglev system and a 180 mph high-performance steel-wheel system similar to the French TGV or West German ICE.

Option 1: Maglev Service

The commission's initial maglev investigation produced a cost estimate of $10 billion for a double-guideway system. At a top speed of 250 mph, this system would have allowed cross-state trip times of about two hours. It would attract the most passengers and create the greatest economic impact. The high cost estimate and difficulty of financing almost immediately ruled out this approach, even though maglev proponents claimed that the engineers' estimates were far too conservative (high), and that realistic costs based upon actual construction experience should be far lower. Methods of economizing on the initial capital cost estimate were unable to be pursued due to the abrupt termination of funding.

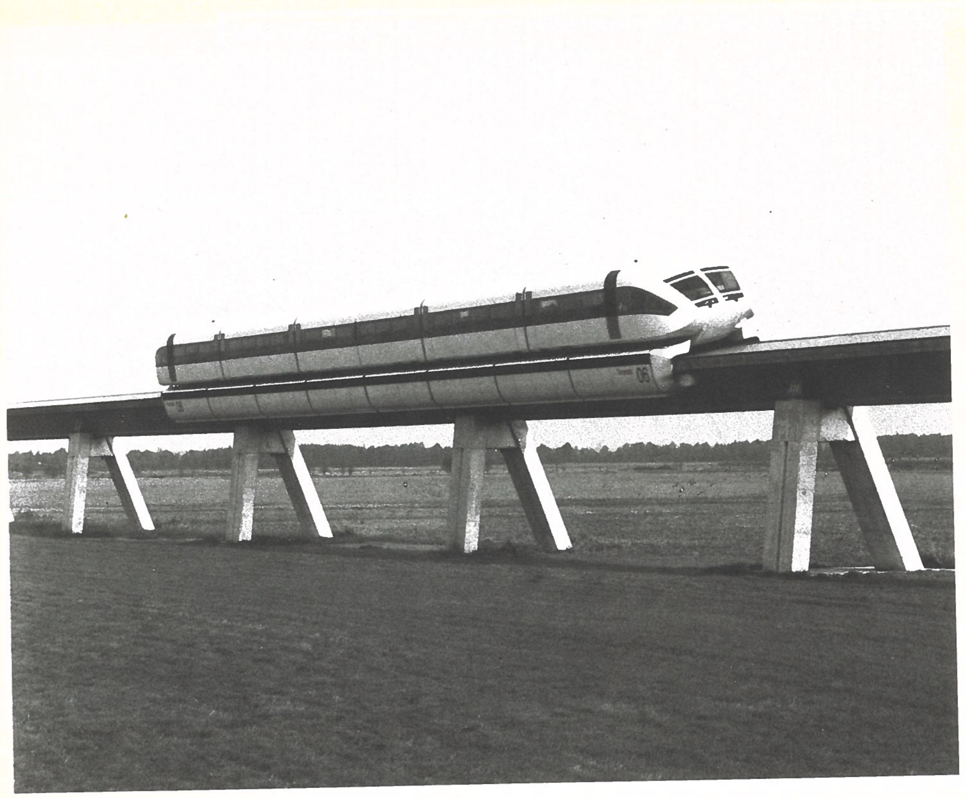
As a result, the West German maglev consortium Transrapid International proposed an incremental, staged plan, starting with partial maglev service and expanding its scope after gaining operating experience and achieving a financial performance level. Because of funding limitations, the commission's consultants were unable to provide an independent assessment of this proposal. The Transrapid proposal would implement a $3 billion, 250 mph maglev system between Harrisburg and Pittsburgh, with initial upgrading of steel-wheel service between Philadelphia and Harrisburg. This plan contains a single-guideway track with two 25-mile passing double tracks and no tunnels. Transrapid officials further have stated that they would assist in procuring offshore public and/or private financing to build such a system in Pennsylvania. Running time for the Harrisburg-Pittsburgh maglev section would be 1 hour 29 minutes, making five stops.

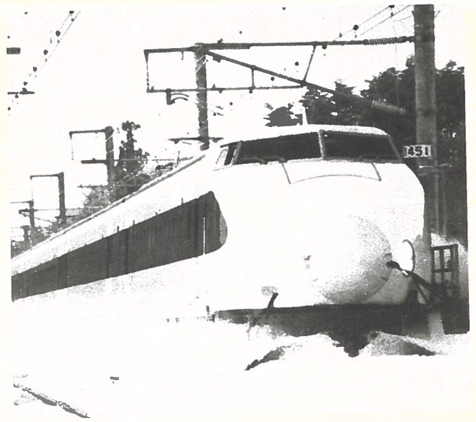
The commission's consultants estimated costs, revenues, performance standards and ridership based on full use of each technology from Philadelphia to Pittsburgh. However, both the commission's engineering consultants and engineers representing maglev and high-speed steel-wheel systems have suggested a staged approach, blending travel on old and new while new construction is completed. This approach offers an immediate improvement to existing service, over what is now the slowest segment, while containing a state-of-the-art component as well. A disadvantage is that it requires passengers to make a cross-platform transfer at Harrisburg until the entire cross-state system is built.

Cost of the incremental system would begin with the Transrapid estimate of $3 billion, plus the cost of upgrading steel-wheel service between Philadelphia and Harrisburg, which must be investigated.

Option 2: High-Speed Steel-Wheel Service

This service proposal resembles the French TGV operation, with trains running at 160-185 mph and taking about 2 hours 41 minutes to make the cross-state run. The commission consultant's initial work produced a capital cost estimate of $7 billion. This initial Phase 1 steel-wheel cost estimate has been called unrealistic in





The world's first high speed train, the Japanese Shinkansen or "Bullet Train," started operation 25 years ago (August 25, 1964). It has a perfect safety record and is a major financial success.

The Transrapid guideway is banked at curves, for passenger comfort.

that it was based on alignment assumptions that used moderate grade-climbing ability and involved extensive tunneling. It has been criticized as conservative (too high) by suppliers, who have a first-hand acquaintance with actual costs of construction. In addition, the estimate has been called extremely conservative — perhaps 25 or 30 percent higher than it need be — by the commission's oversight consultants, who suggest that the capital cost ought to be closer to $5 billion. The TGV Company has offered to provide train-performance data, as well as assistance on costs and revenues, and sources of financing.

Representatives of the French rolling-stock manufacturers stated that they are prepared to make a proposal for such service, and stand ready to assist in procuring financing much in the same manner as the West German consortium.

Option 3: Moderate-Speed Steel-Wheel Service

A modest high speed rail steel-wheel-on-steel-rail electrified system could be built for $2.55 billion. Operating at 125 mph with 150 mph running on some stretches, this system could cut the seven-hour Philadelphia-Pittsburgh travel time to 3 hours 43 minutes. A low-cost alignment design would provide passenger-dedicated track in the existing Amtrak-Conrail corridor with only 50 miles of realignment into new right-of-way. This plan would create a 340-mile route that would enjoy the advantage of a lower capital cost and a much shorter design and construction period. Cash inflow, as a result, would begin in a much shorter time. While not as dramatic as the first two options, this concept would roughly halve the current Philadelphia-Pittsburgh rail travel time of seven hours.

The commission did not have the opportunity to have its engineering consultants thoroughly examine this proposal. The option poses safety concerns, especially with so much of its track location adjacent to existing freight tracks. For a relatively modest cost, it would produce immediate improvements, while allowing for higher performance standards by future straightening of alignment. This approach is not unlike that taken in improving the Pennsylvania Turnpike. However, this option lacks the economic-development potential of the faster systems. Another long-term advantage is that the operating margin would exceed the debt service requirement in the year 2006, the estimated 13th year of operation. Cumulative positive cash flow after debt service would be $14 billion by the year 2027, when the bonds would be retired.

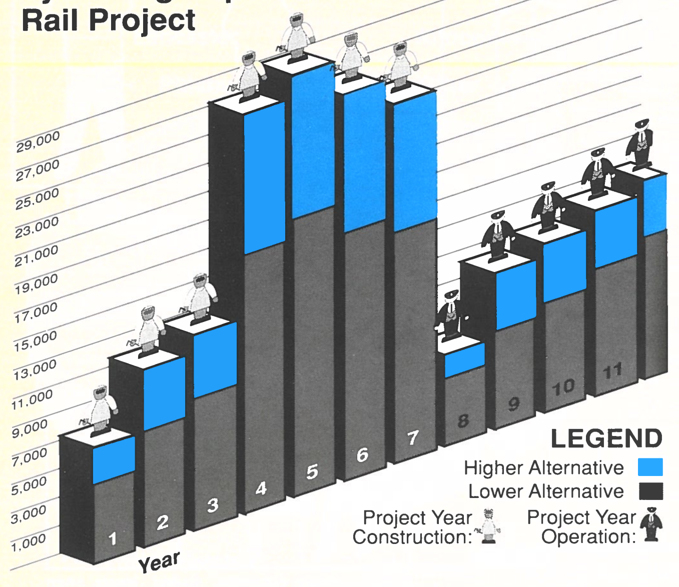
ECONOMIC DEVELOPMENT

High-speed rail would be a catalyst for economic growth — growth that would help the state overcome years of declining investments, jobs, and population; and growth that would help reduce unemployment to a more desirable level, and provide substantial tax income for the Commonwealth.

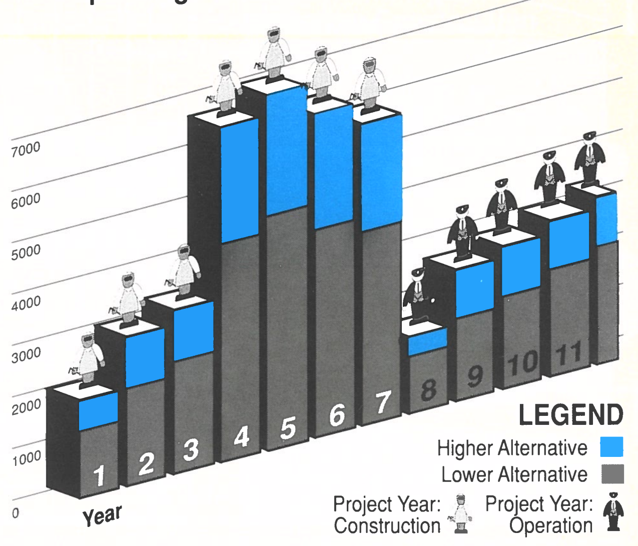
Construction Benefits

At least two-thirds of the expenditures for construction can be gained by Pennsylvania firms. Direct expenditures would stimulate further economic activity through the multiplier effect. For a $2.55 billion steel-wheel system (Option 3), the result is a $6 billion increase in total expenditures during the six-year construction period. For the high-speed steel-wheel system, Option 2, the $7 billion capital expenditure brings an estimated $16 billion in total construction. The maglev system, Option 1, produces $22 billion in construction-period benefits in return for the $10 billion capital cost estimate.

New expenditures mean new construction jobs — as many as 25,000 annually for maglev, or Option 1; 22,000 annually for Option 2; and 13,000 annually for Option 3. This will raise personal income by at least $1.39 billion during construction or $5.34 billion total over the operating life, for the most modest system. Advanced technologies produce $8 billion in personal income (Option 2), or $9.4 billion for Option 1. State government revenues would increase by $492 million (Option 3) to $755 million (Option 2) to $882 million (Option 1) over the construction and operating life of the system. These revenues would be derived through increased income, sales and other tax receipts.



Potential Range of Employment Generated by the High Speed Rail Project



Typical Distribution of Urban Area Employment Impact for the Construction and Operating Periods

Because of the role railroading has played in the state's economy, Pennsylvania already has dozens of railroad-supply firms that manufacture everything from track spikes to locomotives. Roadbuilding contractors could benefit from contracts for right-of-way grading and bridge and tunnel construction.

Operations Benefits

It would cost $98 million annually to operate and maintain a system under the least advanced approach, Option 3. The cost is estimated to be $105 million for Option 2 and $104 million for Option 1, maglev. Some 85 percent of these expenditures would benefit Pennsylvania firms and labor. The result, accounting for the multiplier effect, would be some $460 million annually, under the best case, in new expenditures after operations begin.

These expenditures translate into:

- A total, in direct and indirect employment, of 7,600 to 12,500 jobs.
- Annual personal income of $160 million to $205 million.
- State tax revenues of $15 million to $19 million annually.

Downtown Development

High-speed rail can revitalize downtown areas by stimulating the development of real estate near stations. Construction of retail, hotel, restaurant and office buildings will accompany the introduction of modern, efficient transportation in the downtowns of cities served. This phenomenon already can be observed in Lyons, France, adjacent to the high-speed TGV station there, and is a major component of the Florida high-speed rail system proposal. Harnessing the rising value of real estate is one way to help pay for high-speed rail capital costs.

Structural Benefits

High-speed rail can enhance the ability of a state or region to compete with others for new investment and economic activity. Feasibility studies leading to implementation in other states are taking this into account: Florida (Miami-Orlando-Tampa), Ohio (Cleveland-Columbus-Cincinnati), Texas (Dallas-Houston), Nevada/California (Las Vegas-Los Angeles) and Michigan, Indiana and Illinois (Chicago-Detroit). Regardless of where the first system in America is built, high-speed rail will be a multi-billion-dollar industry. The states that are first to create such a system will be in the best position to export their goods, services and expertise to others.

Travel and Tourism

In France, it is estimated that 20 percent of the travel on the TGV is induced travel, or travel that would not occur were it not for high-speed rail. Such a system could improve access to the recreational areas of Central Pennsylvania, Pittsburgh's sporting events, and the historic sites of Philadelphia. Further, it would foster trade, communication and cultural links between Philadelphia, with its Northeast Corridor orientation and financial centers, and Pittsburgh, with its status as one of the largest corporate-headquarters centers in America.

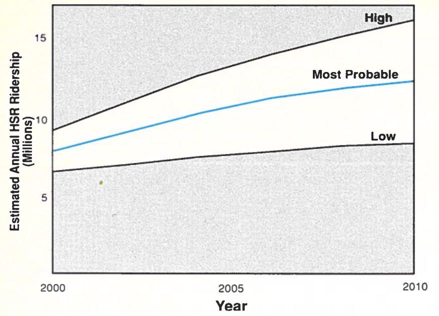
Pennsylvania's Image

Another area is the promotion of Pennsylvania's image as a desirable place in which to do business. This is the most elusive economic benefit to measure, but it is generally recognized that attitude has a great deal to do with industrial development decisions.

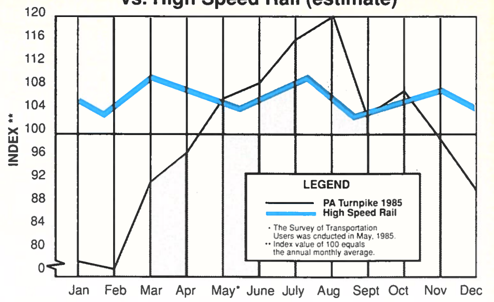
An investment in high-speed rail that is soundly financed and well-operated can demonstrate that a state can do something progressive, positive, imaginative and on a large scale to support its economy. This would make a great difference to businesses trying to decide whether to locate in Pennsylvania.

Accessibility

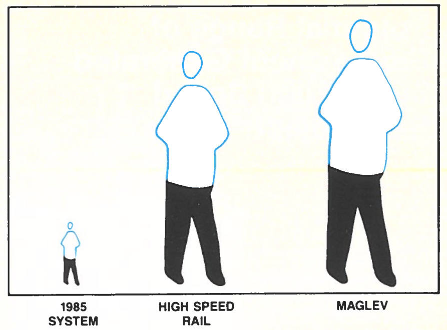
Historically, transportation is at the core of economic development, as can be seen in our highway system, ports and airports, along rapid transit lines and along rail freight corridors. High-speed rail also has the potential to be this kind of economic development catalyst.



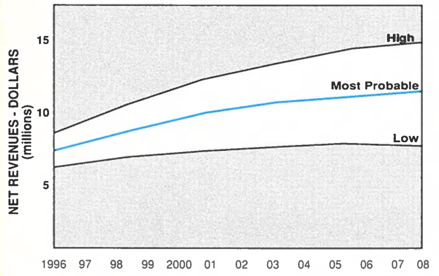
Estimates of MAG-LEV Ridership



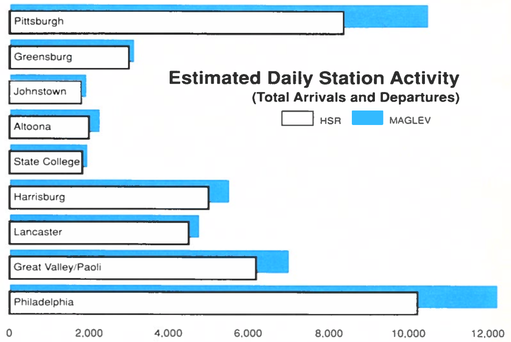
Monthly Traffic Variation For Pennsylvania Turnpike vs. High Speed Rail (estimate)

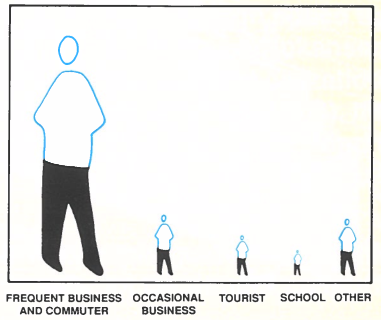


Daily Rail Person-Trips By Rail Type



Mag-Lev Net Revenues





Total Daily Trips By Trip Purpose

Other Benefits

Other benefits associated with high-speed service:

- Lower unemployment and reduced associated costs of public support of jobless workers.
- Opportunities for young skilled workers to remain in Pennsylvania rather than having to move elsewhere to find employment.
- More productive use of time. High-speed rail avoids much of the wasted time associated with traveling to outlying airports, and canceled or delayed flights caused by weather or equipment problems. Most seasoned travelers have learned to allow extra time to account for such delays.
- Improved safety, compared to highway, air and conventional rail travel. The Japanese Bullet Train fleet has operated for 25 years and carried 3 billion passengers, all **without a single fatality.** Well-planned and precisely operated systems running over "dedicated" (to one kind of traffic — high-speed passenger rail) rights-of-way offer the safest transportation known to mankind. The French TGV system, in full operation since 1983, has demonstrated a similar perfect record of safety.

MARKET DEMAND

An extensive ridership survey conducted in May and June of 1985 indicated that by the year 2000, high-speed rail could attract 5.5 million to 8.8 million passengers a year. The analysis surveyed existing travel patterns in the Philadelphia-Pittsburgh corridor and established a formula for ridership projection. The 5.5-million-passenger estimate represents the least-optimistic projection for 180 mph steel-wheel service and the 8.8-million-traveler figure represents 250 mph maglev service under favorable economic and population conditions. To avoid overoptimistic projections, the survey was conducted according to recommendations of the High Speed Rail Association's Standard Guidelines for Revenue and Ridership Forecasting.

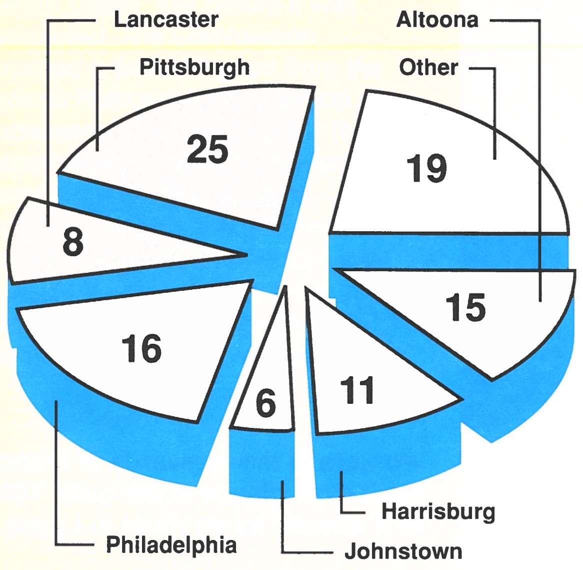
One of the key findings of the study was that most travel in Pennsylvania takes place at an elapsed time of two hours or less. The significance of this is that bringing the eastern and western reaches of the state to within roughly two hours of each other will greatly stimulate the volume of intercity travel.

Frequent business travelers, including some commuters, would constitute the largest subgroup of travelers — about 9,500 to 10,500 trips per weekday, or 57 percent of a total weekday ridership of 16,600 to 18,700 passengers. Occasional business travelers would add another 4,600 to 5,500 passengers each weekday, for 28 percent. Tourists would account for 1,500 to 1,600 riders a weekday, or 9 percent. School trips represent about 500 trips a day.

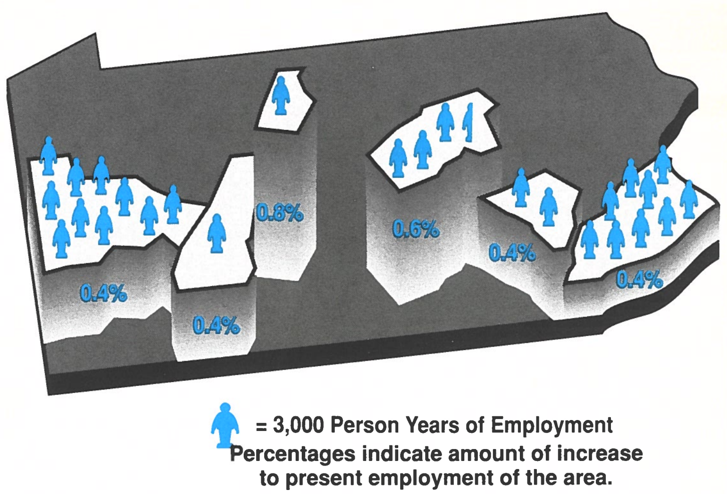
Fares were assumed to range from 16 to 28 cents a mile, with the average being 22 cents a mile. Higher fares would be charged for business travel that is less price-sensitive than other market segments, lower fares for off-peak and incentive travel.

In May and June of 1985, 25,538 questionnaires were handed out to passengers aboard Amtrak trains, to Turnpike motorists and to airline passengers. Of those, 8,853 forms were returned in person or by postpaid mail, for a 34.6 percent response rate. Questionnaires were intended to find out who is traveling in the corridor, how often, why and by what means; what time of day they travel; how long it took to make the total trip; origin and destination; and who is paying for the travel. In August 1985, commission consultants conducted a series of subjective market research surveys in Philadelphia, Harrisburg, and Pittsburgh, using 215 randomly recruited volunteers. They were tested in a focus-group setting to determine the criteria they use in choosing how they travel, specifically, how much weight they placed on such important but difficult-to-quantify aspects as comfort, convenience, amenities, reliability, security and perceived safety.

The most important factors, the survey found, were schedule reliability, cost, frequency and average speed or travel time. The most important characteristics for frequent business travelers were cost, reliability and frequency. Weather vulnerability also played an important role. Those who travel for other trip purposes (tourist, school, "other") judged trip time, cost, reliability and frequency to be the most important factors.



Benefits by Region Operations Period



Distribution of Employment Impacts Among Urban Areas During Construction
(Average of Lower and Higher Alternatives)

0.8%
0.6%
0.4%
0.4%
0.4%
0.4%
= 3,000 Person Years of Employment
Percentages indicate amount of increase to present employment of the area.

FINANCING

Editor's Note: Preliminary financing studies were initiated by the commission's consultants. Before a detailed study could be accomplished, funding was discontinued. In the meantime, there have been new technology developments and new Federal legislation, which provides for tax-free bonding for high speed rail projects. These developments have completely altered the bottom line. Consequently, no valid financial package exists for the options considered in the study. A financial plan should be developed.

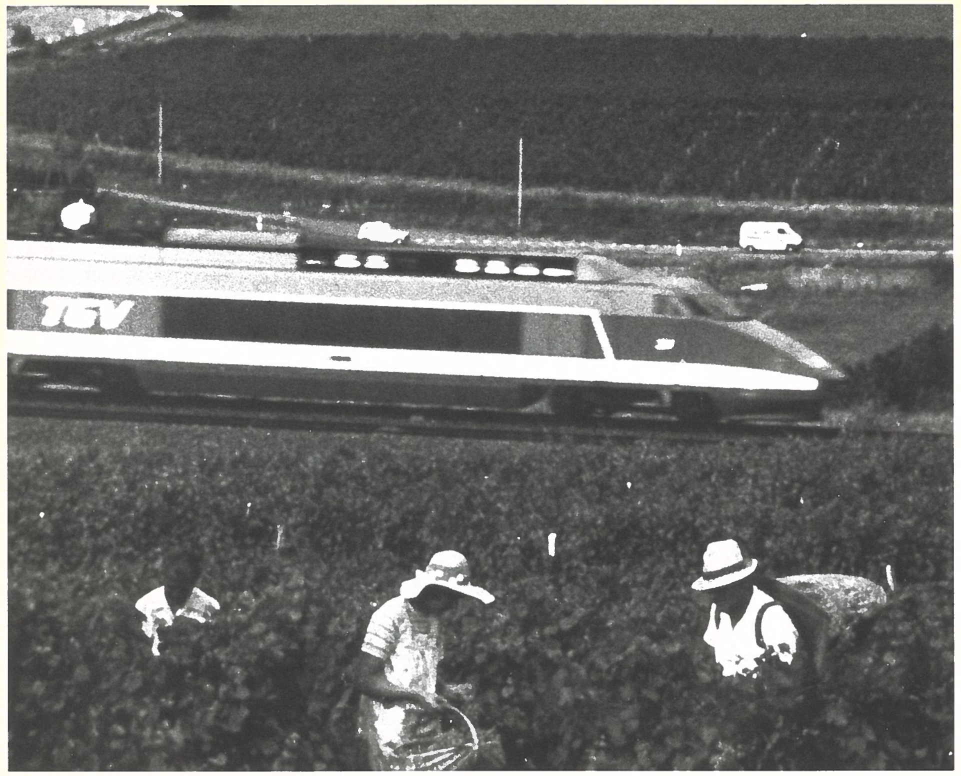
The information that follows is based on preliminary financing studies conducted by the consultants in 1987 and earlier, and should be considered only in that context. Computations were made on the basis of 1986 dollars.

A synopsis of the financing work performed for the commission follows; it is derived from data provided to the commission by the general engineering consultant and computer spread-sheets provided by the financial subconsultant in March 1987. As noted in the introduction to this report and in the recommendations, it does not address some avenues of capital funding that are now being pursued in other states.

The preliminary financing analysis performed for the commission draws the conclusion that the only affordable high-speed rail system is that which uses the least advanced technology and costs about $2.55 billion. This automatically ruled out any consideration of maglev (Option 1) or the high speed steel-wheel technology (Option 2), without further study as to how cost estimates could be reduced or how construction could be advanced in stages. Conservative in nature, this approach was based on a premise that no federal assistance, of any kind, is available and that no foreign financing can be found. Further, it did not take into account methods by which the presumed lid on capital costs might be overcome. These means include considering the cash contribution available from real estate value-capture programs, which would turn revenue derived from the retail, hotel and office development in the vicinity of stations back to the high-speed rail system.

Excluding these potential revenue-producers resulted in an assumption that the only source of capital funding is the Commonwealth itself, on a full faith-and-credit basis. However, representatives of foreign suppliers have offered to help locate sources of foreign financing to build high-speed rail in the United States and specifically, Pennsylvania. And, by requesting that the general engineering consultant produce a station development report, the commission clearly indicated its intent to harness real estate values to make the system more financially self-sustaining. The federal political climate and deficit-reduction sentiment at the national level suggest that direct federal grants to build such a project are not in the offing. However, federal assistance in a form other than direct capital outlay could substantially aid the project, specifically in the form of tax-free status for revenue bonds. (This status was achieved in 1988 with the addition of high speed rail to the list of transportation modes eligible under the federal tax laws.)

The results of the commission's financing analysis are accurate in preliminary fashion, within the narrow context in which they were conducted, but incomplete. It is these additional areas of financing details that were to have been addressed during the final phase of the commission's work, and which should be studied in any further consideration toward implementation of high-speed rail. A re-evaluation of the financial assessment would be necessary in any event in view of the significant tax-law changes that have ensued. Further, Phase 1 capital costs were extremely conservative; lower costs resulting from optimized alignment work were not developed, and reviewing this issue also will be necessary for any subsequent reexamination of the proposal. No discussion of financing high-



Workers in the vineyards of France don't even glance at the quiet TGV as it streaks by en route to Lyons.

speed rail in Pennsylvania can be complete without reference to the West German consortium of Transrapid International. Transrapid proposed in the spring of 1987 to design and build a maglev system between Harrisburg and Pittsburgh at a cost not exceeding $3 billion, and pledged its assistance in locating offshore capital financing. This engineering proposal is contained in an addendum to the full final report. A representative of the TGV Co., suppliers of the French steel-wheel high-speed train, subsequently made a similar offer.

The financial consultants assumed that the only source of funding for capital expenditures would be the Commonwealth and concluded that both the early $7 billion high-speed (180 mph) steel-wheel plan and the early $10 billion maglev plan contained considerable investment risk and were not financeable. Using the same premise, these consultants said a lower-performance (125 mph, with a few stretches of 150 mph operation) system costing $2.55 billion could be financed.

The commission believes that the financing analysis is accurate but it overlooks significant instruments by which a plan could be implemented, thus missing the point of the feasibility study. Detailed and realistic financing analysis are requisite before high-speed rail can be implemented.

The commission's consultants have studied the benefits and drawbacks of structuring the system as a public, private or joint public-private entity, but no conclusions were reached.

Without a detailed project proposal, no firm conclusion can be drawn, but a public body would be an appropriate means by which to begin the project.

ENVIRONMENT

The ecological effects associated with a high speed rail system would be much less severe than those associated with building new interstates or airports. In virtually all categories — land required, energy consumption, noise, vibration, air pollution and aesthetic intrusion — railroads are potentially less damaging to the environment than airports or freeways.

Land Use and Aesthetic Intrusion

In areas where all-new right-of-way is needed, some landowners may object to intrusion. The intrusions can be minimized by careful site selection — e.g., by paralleling interstate highways or existing rail lines, by using shock-absorbing elements, or by locating the track on an elevated structure or under ground. However, tunneling can cost many times more than at-grade construction, and may be unavailable near urban freeways.

On the other hand, the amount of right-of-way needed for a double-track railroad is comparatively small. The entire 265-mile double-track route of the Paris-Lyons Line occupies less land than the DeGaulle Airport in Paris.

A promising mitigation measure is to elevate the system (particularly with maglev technology) so that only an easement, rather than outright property acquisition, would be required. This would be particularly advantageous through agricultural areas where the high speed system need not halt present land use.

Noise, Vibration and Air Quality

All the systems studied use high technology equipment that is inherently quieter than existing rail systems. Electrically powered trains minimize propulsion noise, and such devices as continuous welded rail, elastomeric track pads, floating slabs and acoustical barriers can reduce noise and vibration. Maglev systems are potentially attractive, because there is no contact between vehicle and guideway. A relatively low frequency — hourly services in each direction as assumed throughout the study — means that noise impact would be low.

Air pollution from railroads is minimal, especially in electrified operations, where emissions from burning fuel are confined to power plants. The level of pollutants emitted by power rail passenger vehicles is miniscule, compared to emissions from other transportation modes, notably highway vehicles and aircraft. Electric utilities along the proposed system have enough reserve capacity to supply high speed rail without requiring construction of new generating stations.

FOR THE RECORD

The four-year, $4 million Pennsylvania high speed rail study was halted by the administration of Gov. Robert Patrick Casey just before it was completed. The Commission obtained a $44,000 grant from the Federal Railroad Administration for publication of a Final Report. The Report was prepared by several ex-commissioners and ex-staff members. At first, the governor's people refused to accept the grant and refused to publish the Report. After considerable urging by the public, the grant was accepted and the Report was published two years after the study was terminated (only 700 copies were printed).
However, the Report was in "words only" without benefit of maps, charts, graphs and photos. This was because a representative of the governor refused to allocate any of the Federal grant to provide illustrations. Now, however, due to a grant to the High Speed Rail Foundation from Transrapid International, some illustrations were made possible for this Executive Summary.

The Commission: Front, Mrs. Dottie Ketner, (executive secretary); front row, Richard C. Sullivan, Dan Cupper (executive editor); guest John Riley, (Federal Railroad Administrator); Robert A. Gleason, Representative Amos K. Hutchinson, Scott Casper (executive director of the House Transportation Committee); and Eric Bugaile (executive assistant); back row, Robert A. Patterson, Robert J. Casey (executive director of the Commission); Kant Rao, Everett W. Croyle, Representative Rick Geist, Lowell Witmer (representing Senator J. Doyle Corman) and Senator J. Barry Stout.

High Speed Rail and the Environment

While most transportation systems are a burden to the environment, high speed rail is not. Both magnetic levitation and advanced steel wheel systems provide high speeds, comfort and safety, but do not produce air pollution, hazardous waste or harmful noise.

In comparison with highways and air systems, high speed rail uses minimal land. The entire Paris to Lyons TGV system does not use as much land as the DeGaulle Airport near Paris.

High Speed rail systems use only a narrow band right-of-way and can be elevated to permit farming and other activities under the guideway. Note the front cover. Because the passing vehicle is floating quietly by, the cows graze peacefully underneath.

According to Victoria Tschinkel, former secretary of the Florida Department of Environmental Regulation:

"Air pollution in our state comes largely from automobiles. Ninety percent of the carbon monoxide, fifty percent of the nitrogen oxide, and sixty percent of all the volatile organic compounds come from cars ... We look to high-speed rail as a unique opportunity for trying to reduce the drastic impacts on our air resources."

Photo by R.J. Casey